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MEMOIRS

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GEOLOGICAL SURVEY

OF

THE UNITED KINGDOM.

Figures and Descriptions

ILLUSTRATIVE OF

BRITISH ORGANIC REMAINS.

DECADE IV.

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BRITISH FOSSILS.

DECADE THE FOURTH.

All the plates and descriptions in this Decade are devoted to fossil Echinodermata of the order *Echinoidea*.

The genera selected for illustration are *Temnechinus*, *Acrosalenia*, *Hyboclypus*, *Hemipneustes*, *Ananchytes* with its section *Holaster*, and *Cardiaster*. The geological age of the first is Upper Tertiary, of the second and third Oolitic, of the remainder Cretaceous. Several of the species are represented for the first time.

Temnechinus is a genus remarkable for its species being at present known only as fossils of the Coralline and Red Crags; it is now characterized for the first time.

The examples of *Acrosalenia* selected are both remarkable for their beauty and their very perfect condition. They are also of much interest, one on account of the rectification of its true generic position, which I have been enabled to make through the aid afforded by very perfect specimens: the other, because of the complete preservation exhibited by the specimens described of parts too often lost in fossil Echinoderms. I have appended to the descriptions of these *Acrosaleniæ* brief characters of some new species of this interesting oolitic genus.

Hyboclypus is illustrated by the finest and largest species of the genus, one discovered during the researches of the Geological Surveyors.

Hemipneustes, to which genus I unite *Toxaster*, is now for the first time authentically represented by a British example, remarkable for its novelty and for the light it throws upon the mutual affinities of those genera of *Echinoidea* which have excentric mouths.

The well known genus *Ananchytes* is combined (as indeed it was formerly by Lamarck) with *Holaster*. In selecting the common *Ananchytes ovata* of the Chalk for the subject of a plate and description, I have been influenced by the necessity of clearing up the confused synonymy of this fine fossil, and of settling the numerous spurious species which have been constituted out of its varieties, or from imperfect figures contained in old works.

Cardiaster is a new genus, lately constituted by myself for some remarkable and interesting sea-urchins, intermediate in their characters between *Ananchytes* and the true *Spatangidæ*. To the account of the species figured I have added notices of all the forms of this curious type which are known to me as British.

EDWARD FORBES.

October, 1852.

BRITISH FOSSILS.

Decade IV. Plate I.

TEMNECHINUS EXCAVATUS.

[Genus TEMNECHINUS. Forbes (1852). (Sub-kingdom Radiata. Class Echinodermata. Order Echinoidea. Family Echinidæ.) Body spheroidal; ambulacral and interambulacral segments developed, bearing on their plates, whose sutural margins are excavated but not perforated on the dorsal surface of the test, tubercles of various sizes, imperforate and placed on smooth bosses. Vent in the centre of the prominent apical disk, which is composed of five genital and five ocular plates, all perforated. Ambulacral avenues composed of pairs of pores indistinctly ranked; the ranks confluent throughout. Mouth central, inferior, armed with a powerful dental lantern. Spines of one order, but of various sizes.]

Synonyms. *Temnopleurus excavatus*, Searles Wood, in Morris Cat. Brit. Foss. p. 60. (1843.)

Temnopleurus Woodii, Agassiz, Cat. Rais. des Echin. in Ann. Sc. Nat. 3d series, t. vi. p. 360. (1846.) *Temnechinus excavatus*, Forbes, Brit. Tert. Echin. p. 6, pl. 1, fig. 1. [published by the Palæontog. Soc.] (1852.)

Diagnosis. *T. corpore depresso, superne subexcavato, sulcis suturalibus profundis confluentibus.*

It is very remarkable that a group of Echinidæ differing essentially and generically from any known assemblage should be characteristic of the Coralline and Red Crag formations of England, and at present be known only as confined to them. The type of this genus is the form here described. I have named the group Temnechinus (τεμνος, *incisus*, and εχινος).

This beautiful Echinite was originally named by Mr. Searles Wood and placed by Professor Agassiz in his genus *Temnopleurus*, under which it was enumerated by Mr. Morris in his catalogue. But *Temnopleurus* has imperforated tubercles elevated upon crenulated bosses, a striking and easily recognized character, shared also by *Salmacis*. *Temnechinus* accordingly will hold a position intermediate between these genera and *Echinus* strictly so termed. In the arrangements of its genital disk it exhibits considerable peculiarities of its own. Its spines resemble more nearly those of

Echinus than those of the other genera just mentioned. In the disposition of the pores of the ambulacral avenues it approaches *Temnopleurus* rather than *Echinus* or *Salmacis*.

No *Echinidæ* with excavated sutures are now known to exist in the European seas or in the temperate and colder portions of the North Atlantic; they are all inhabitants of tropical seas, and especially of the Indo-Pacific province. The fact of a group of these sea-urchins having inhabited the British area during the epoch of the deposition of the Crags would seem to indicate some ancient relation between that region and seas to the south-east, probably communicating with the Indo-Pacific.

The body of *Temnechinus excavatus* is of a depressed melon shape. The ambulacra are a little more than half as broad as the interambulacra. The former are composed of about 32 plates, 16 in each series. The three uppermost of these plates are deeply excavated on their inner sides, and bear granules but no tubercles on their more convex portions. The remainder bear each a primary tubercle on the outer margin. They are all excavated more or less on their inner sides, the excavations of the four or five upper ones becoming confluent, those of the remainder forming distinct alternating oblong pits, which become smaller and smaller until they are nearly obsolete in the neighbourhood of the mouth. The elevated interstices form a ziczac ridge, the outer angles of which join the bases of the primary tubercles; on this ridge are minute secondary tubercles and granules. The plates of each interambulacral segment are about 20, ten forming each vertical series. The two uppermost joining the genital disk are smooth or nearly so; the remainder bear each a primary tubercle not larger than those of the ambulacra. The four plates next after the uppermost in each row are tumid on their outer halves, very deeply and steeply excavated on their inner sides. On the inner sides of the tumid portions are the primary tubercles surrounded by secondary tubercles and granules. Their excavations combined form a deep ziczac trench, smooth at the base. The remainder of the plates are similarly ornamented with tubercles and granules; the sutural indentations, however, are not confluent, but form deep loop-shaped smooth pits, becoming very small near the mouth. The lines of division between plates run through the pits. The avenues of pores are deep-set, and are composed of pairs of pores separated by fine ridges and ranged in single file, the rows being undulated. There are about 50 pairs of pores in each row.

When the test is looked upon from above, the deep wavy furrows are those of the interambulacral sutures. Below, the indentations are so slight that the surface at first glance resembles that of a *Salmacis*.

The mouth is less than one third of the diameter of the test, and one fourth wider than the breadth of the genital disk. It is very obscurely ten-notched. The ambulacral arches are seen within it, large, complete, and set obliquely.

The apical disk is composed of five perforated genital and five perforated ocular plates surrounding the vent. The genital plates are nearly equal, very elevated and prominent, with steep, smooth, slightly excavated sides and triangular summits covered with minute secondary tubercles (innermost) and granules. The madreporiform body is small and combined with the usual plate, the contour of which it scarcely disturbs. The genital pores are placed in the lowest and outermost portion, the smooth triangular projection in front of the base of each plate. The eye plates are large, pentagonal, and smooth, except a large obscurely defined gibbosity or rudimentary tubercle rising on their centres immediately above the eye-perforation, which is situated at their outer margins.

The primary spines are rather short and stout, with strong articular bases. They are sulcated by about ten strong furrows; the intermediate ridges are broader than the furrows and as if crenulated. The secondary spines appear to have been similar but more slender and delicate.

A fine specimen measures $\frac{1}{1\frac{1}{2}}$ths of an inch in breadth by $\frac{5}{1\frac{5}{2}}$ths of an inch in height. Examples vary in their proportions. The sulci are as strongly marked in an example little more than half that size as in the large one.

In some of the earlier lists of Crag fossils a *Cidaris* is mentioned. This *Temnechinus* was probably the sea-urchin intended.

Locality and Geological Position. Coralline Crag of Ramsholt in Suffolk. I owe to Mr. Searles Wood, Mr. Charlesworth, Dr. Clarke of Ipswich, and Mr. Bowerbank, the opportunity of examining most of the specimens that have ever been found. A fine example is contained in the Museum of Practical Geology, to which it was presented by Mr. Searles Wood.

Explanation of Plate I.

Fig. 1. Upper side of *Temnechinus excavatus*, showing the deep and conspicuous interambulacral sulcations.
Fig. 2. Under side.
Fig. 3. Side view of the same specimen.
Fig. 4. The apical disk seen from above and magnified.
Fig. 5. The same seen laterally, showing the steep sides of the genital plates, and the intermediate eye plates.
Fig. 6. Ambulacral and interambulacral plates, taken from the sides just below the confluent sulci.
Fig. 7. Similar plates, taken from the neighbourhood of the mouth.
Fig. 8. An internal ambulacral arch.
Fig. 9. A spine highly magnified.

Note on the species of Temnechinus.

I have met with four species of this genus, all of which are described in my "Monograph of British Tertiary Echinoderms," contained in the publications of the Palæontological Society. These are

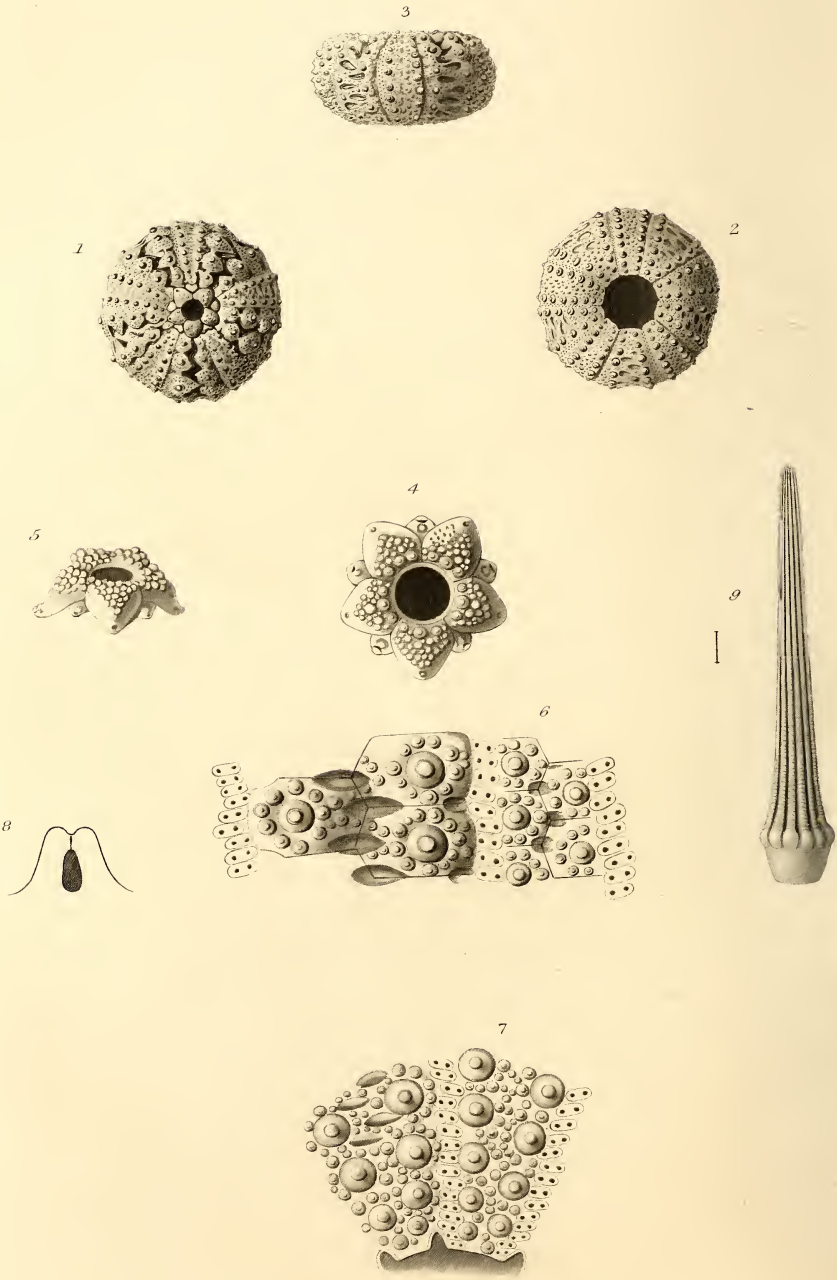
1. *Temnechinus turbinatus.* Forbes.
   From the Red Crag of Sutton.
2. *Temnechinus excavatus.* Wood.
3. *Temnechinus melocactus.* Forbes; and
4. *Temnechinus globosus.* Forbes.
   All three from the Coralline Crag.

Edward Forbes.

October, 1852.

Geological Survey of the United Kingdom.

TEMNECHINUS
(Tertiary)



TEMNECHINUS EXCAVATUS — *Wood.*